a) Solubility Equilibrium SCH4U1

1a)

least soluble				most soluble
AgI	Ag_2CrO_4	Ag_2CO_3	AgCl	$AgNO_3$

1b) $AgI(s) \rightleftharpoons Ag^{+}(aq) + I^{-}(aq)$

b) Acid-Base Equilibrium

3a)

Neutral	Acidic	Basic
KNO_3	N_2H_5Cl NH_4I	LiC_6H_5COO LiCN

3b)

Acidic
$N_2H_5^{1+}(aq) + H_2O(l) \rightleftharpoons N_2H_4(aq) + H_3O^{1+}(aq)$ $NH_4^{1+}(aq) + H_2O(l) \rightleftharpoons NH_3(aq) + H_3O^{1+}(aq)$

Basic
$C_6H_5COO^{1-}(aq) + H_2O(l) \rightleftharpoons C_6H_5COOH(aq) + OH^{1-}(aq)$ $CN^{1-}(aq) + H_2O(l) \rightleftharpoons HCN(aq) + OH^{1-}(aq)$

Unit 3: Atomic Structure and Classification of Solids

1)

Bohr	introduced the idea of electrons with quantized energy resulting in energy levels of fixed energy
DeBroglie	wave/particle duality - electrons can be considered as both having particle and wave like properties
Heisenberg	uncertainty principle - the exact location of an electron cannot be known with any degree of certainty, lead to the concept of orbitals
Schrodinger	developed wave equation that can be used to predict regions of probability of finding electrons
Pauli	Pauli exclusion principle - only two spin paired electrons can occupy the same orbital

2a) An orbital is a region or volume of space around an atomic nucleus in which there is a 95% chance of finding an electron.

2b) Maximum # electrons = $2n^2$

2c)

n = 2 2 sublevels: 2s and 2p 2s = one spherical shaped “s” orbital 2p = three dumbbell shaped “p” orbitals along x,y and z axes	n=4 4 sublevels: 4s, 4p, 4d, 4f 4s = one spherical shaped “s” orbital 4p = three dumbbell shaped “p” orbitals along x,y and z axes 4d = five “d” orbitals

3)

$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

$-3028 kJ$

$m = 550.0 g$ $n = ?$

$\Delta T = 87.5$

$q = m \cdot c \cdot \Delta T$

$= (550 g)(~~?~~.18)(87.5)$

$= 201,355$ ~~?~~J

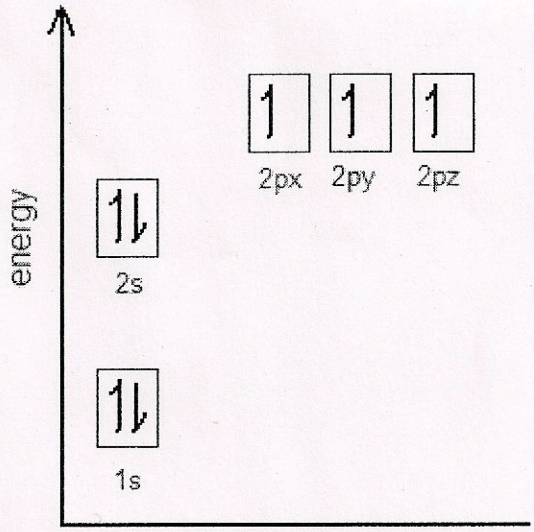
$\Delta H = \frac{-q}{n}$

molar enthalpy

$\Delta H = \frac{-q}{n}$

$n = \frac{-q}{\Delta H}$ $n = \frac{-201,355 kJ}{-1560 kJ/mol}$

$= 0.13$



$_7N$

	n	l	m_l	m_s
1s	1	0	0	± ½
2s	2	0	0	± ½
2p	2	1	-1	+½
	2	1	0	+½
	2	1	+1	+½

4) $_{27}Co$ $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^7$ Fe^{2+} $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6$

5)

Compound	General formula	Shape	Polarity
PCl_3	AX_3E	trig. Pyramidal	polar
SiF_4	AX_4	tetrahedral	non-polar
CO_3^{2-}	AX_3	planar triangle	N/A
H_2S	AX_2E_2	bent	slightly polar
$XeCl_4$	AX_4E_2	square planar	non-polar
PO_4^{3-}	AX_4	tetrahedral	N/A
O_3	AX_2E	bent	non-polar
CO	AX	linear	polar
NO_3^{1-}	AX_3	planar triangle	N/A
SF_4	AX_4E	see-saw	polar

6) Fluoromethane is a polar molecular solid while methane is a non-polar molecular solid. The DDF between CH_3F molecules will be much stronger than the LDF between CH_4 molecules. As a result, CH_3F will have a higher BP than methane.

7) Iodine is a non-polar molecule and will therefore be more soluble in a non-polar solvent like tetrachloromethane rather than the very polar water.

8) ethanal:

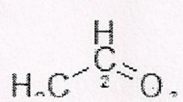
a,b,d) $C_1 = sp^3$ hybridization, tetrahedral arrangement, 109.5°

$C_2 = sp^2$ hybridization, planar triangular arrangement, 120°

c) $[C_1(2sp^3)$ -σ- $H(1s)]$ x3

$C_1(2sp^3)$ -σ- $C_2(2sp^2)$

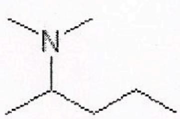
$C_2(2sp^2)$ -σ- $H(1s)$

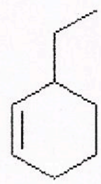


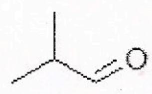
A	molecular (polar)	methanol
B	network	quartz
C	molecular (non-polar)	sulphur
D	metallic	aluminum
E	ionic	potassium chloride
F	molecular (non-polar)	methane
G	ionic	calcium oxide

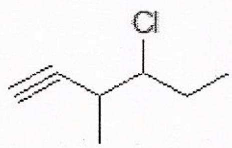
Unit 4: Organic Chemistry

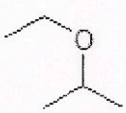
1)

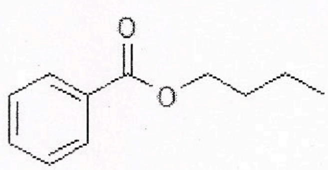
a) 

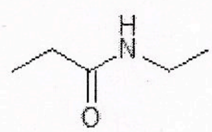
b) 

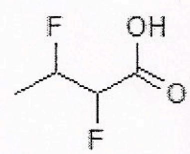
c) 

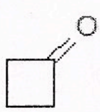
d) 

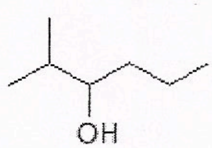
e) 

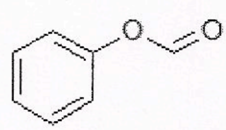
f) 

g) 

h) 

i) 

j) 

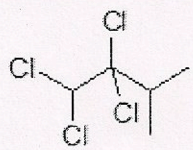
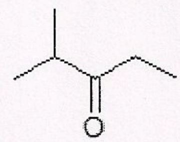
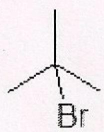
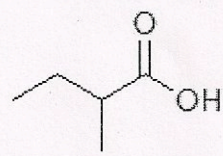
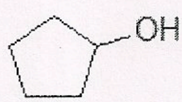
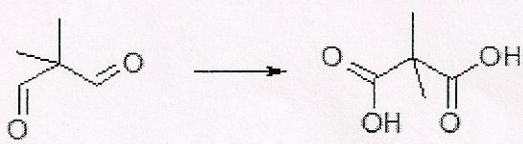
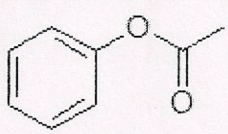
k) 

l) 

2)

a) 3-ethyl-4methyl-2-hexene
b) 3,5-dimethylcyclohexene
c) 3,4,5-trimethylheptane
d) 3-methyl-1,3-pentadiene
e) isopropylcyclopentane
f) 3-methylbutanal
g) 2,4-cyclopentadiene-1-ol
h) cyclohexanone
i) 1,3-dichlorobenzene (m-dichlorbenzene)
j) 2,3-butanediol
k) 1-ethoxypropane
l) methylpropanoate
m) 2-hexanone
n) butanoic acid
o) ethylbenzoate
p) N,3-dimethyl-2-butanamine
q) N-ethyl-N,2,4-trimethyl-3-pentanamine
r) N-isopropylbutanamide

a) 3-methyl-1-butyne + $2Cl_2$ ⇒ 1,1,2,2-tetrachloro-3-methylbutane
b) methane + excess O_2 ⇒ CO_2 + $2H_2O$
c) 2-methyl-3-pentanol + $KMnO_4$ ⇒ 2-methyl-3-pentanone
d) methylpropene + HBr ⇒ 2-bromo-methylpropane
e) 2-methylbutanal + $KMnO_4$ ⇒ 2-methylbutanoic acid
f) cyclopentene + H_2O (H_2SO_4 catalyst) ⇒ cyclopentanol
g) dimethyl-1,3-propandiol + $KMnO_4$ ⇒ dimethylpropanedial ⇒ dimethylpropanedioic acid
h) ethanoic acid + phenol ⇒ phenylethanoate + water

a) 	c) 
d) 	e) 
f) 	g) 
h) 	

4)

propanone	2-propanol	2-chloropropane	propanoic acid	propane
dipole-dipole	H-bonding	dipole-dipole	H-bonding	LDF
highly soluble	highly soluble	slightly soluble	highly soluble	insoluble

lowest BP	highest BP
propane < 2-chloropropane < propanone < 2-propanol < propanoic acid	

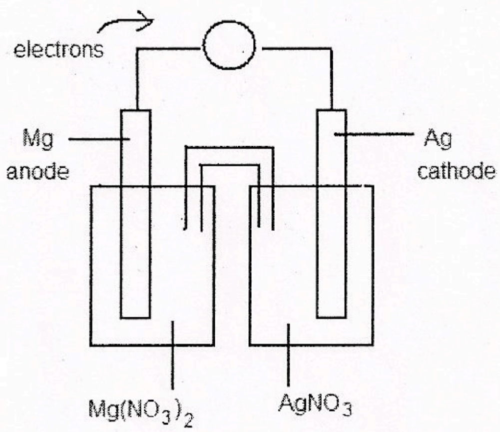
1)

red ½ rxn: $Cl_2 + 2e^{1-} \Rightarrow 2Cl^{1-}$	$E_r = 1.36$ V
ox ½ rxn: $Zn \Rightarrow Zn^{2+} + 2e^{1-}$	$E_{ox} = 0.76$ V
cell: $Cl_2 + Zn \Rightarrow Zn^{2+} + 2Cl^{1-}$	$E_{cell} = 2.12$ V

red ½ rxn: $Pb^{2+} + 2e^{1-} \Rightarrow Pb$	$E_r = -0.13$ V
ox ½ rxn: $2Na \Rightarrow 2Na^{1+} + 2e^{1-}$	$E_{ox} = 2.71$ V
cell: $Pb^{2+} + 2Na \Rightarrow 2Na^{1+} + Pb$	$E_{cell} = 2.58$ V

red ½ rxn: $Au^{3+} + 3e^{1-} \Rightarrow Au$	$E_r = 1.50$ V
ox ½ rxn: $3Ag \Rightarrow 3Ag^{1+} + 3e^{1-}$	$E_{ox} = -0.80$ V
cell: $Au^{3+} + 3Ag \Rightarrow Au + 3Ag^{1+}$	$E_{cell} = 0.70$ V

2)



red ½ rxn: $2Ag^{1+} + 2e^{1-} \Rightarrow 2Ag$ $E_r = 0.80$ V
ox ½ rxn: $Mg \Rightarrow Mg^{2+} + 2e^{1-}$ $E_{0x} = 2.37$ V
cell: $2Ag^{1+} + Mg \Rightarrow 2Ag + Mg^{2+}$ $E_{cell} = 3.17$ V

3)

a) $5H_2C_2O_4 + 6H^{1+} + 2MnO_4^{1-} \rightleftharpoons 10CO_2 + 2Mn^{2+} + 8H_2O$

b) $Cr(OH)_6^{3-} + 3BrO^{1-} \rightleftharpoons CrO_4^{2-} + 3Br^{1-} + H_2O + 4OH^{1-}$

c) $2KNO_3 + 10K \rightleftharpoons 6K_2O + N_2$